

Working Group I: Biology Scientific Group Summary Report

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The group considered several questions:

- What are the frontiers of structural biology?
- To which of these can new, hard X-ray sources contribute? In what way?
- Which classes of experiments look the most promising?
- What is the relevance of "femtosecond biology"?

We considered that at this stage, two classes of experiments look the most promising, for which a semi-quantitative experimental case should be developed: dynamics and imaging.

Dynamics experiments are aimed at mechanism in the broadest sense, from the fs to the ks time scale. They are likely to be pump-probe style and to utilize Laue rather than monochromatic techniques, which emphasizes the usefulness of the spontaneous emission spectrum rather than the SASE lines. They will exploit the temporal structure, probably not the coherence; brilliance is advantageous but not necessarily determining. A chirped hard X-ray beam could be readily exploited.

Imaging experiments might aim at either the cellular/organelle/organism level, on length scales of 10 - 1000 nm, or at the molecular level, on length scales of 0.1 - 50 nm. In both cases, the extent of order needed and the number of entities (cells, molecules....) that must be imaged to obtain a suitable signal are critical.

Both imaging and dynamics experiments are likely to be limited by radiation damage, both from the X-ray pulse and from (for example) the initiating laser pulse in a pump-probe experiment. The essence of a dynamics experiment is the ability to make repeated measurements on the same sample in real time, which implies that all components of the experiment at a single time point must be non-destructive.